FIELD ARTILLERY METEOROLOGICAL CREW MEMBER
MOS 13W SKILL LEVEL 1

PERFORM SURFACE OBSERVATIONS

SUBCOURSE FA 6053
Edition A

US Army Field Artillery School
Fort Sill, Oklahoma

Six Credit Hours

GENERAL

This subcourse is designed to train the skills necessary for performing tasks related to determining and recording surface pressure, wind speed and direction, and performing and recording a limited surface observation.

LESSON 1: Determine and Record Surface Pressure

TASK NO: 061-303-1007

TASK: Determine and record surface pressure.

CONDITIONS: You will be given a barometer (ML-102(*) or ML-333), a DA Form 4197, and a pencil. This task will be performed in an area protected from the elements.

STANDARDS: 1. Determine pressure to the nearest 0.1 millibar and record it.

2. Complete this task within 5 minutes.

LESSON 2: Determine and Record Surface Wind Speed and Direction

TASK NO: 061-303-1013

TASK: Determine and record surface wind speed and direction.

CONDITIONS: You will be given an anemometer ML-433/PM, the magnetic to true declination for your area, FM 6- 15, a DA Form 4469 (Wind Computation), scratch paper, and a pencil.

STANDARDS: 1. Determine the surface wind speed to the nearest knot and the direction to the nearest 100 mils and record them.

2. Complete this task within 5 minutes.

LESSON 3: Perform and Record a Limited Surface Observation

TASK NO: 061-303-1107

TASK: Perform and record a limited surface observation.

CONDITIONS: You will be given a DA Form 5033-R (Limited Surface Observation), FM 6-16-2, an anemometer ML-433/PM, a psychrometer, ML-224, a barometer ML 102(*) or ML-333 if available, and octant, location, and height of met station.

STANDARDS: Determine surface weather to an accuracy of ±0.2 millibar of pressure, wind direction to the nearest 10^0, wind speed to the nearest 1 knot, and temperature to the nearest 1.0^0 C if instruments are available. Record weather elements in SUPRP code as prescribed in FM 6-16-2 without error.

TABLE OF CONTENTS

ADMINISTRATIVE INSTRUCTIONS

Subcourse content. This subcourse contains three lessons, each related to one or more meteorological tasks. An introduction presents an overall view of the subject. Each lesson then explains how to perform each task as it pertains to the field artillery meteorological crewmember.

Supplementary requirements. Subcourse FA 6052 is a prerequisite to this subcourse.

References. You may refer to FM 6-16-2, Tables for Artillery Meteorology (Visual) Ballistic Type 3 and Computer Messages and Limited Surface Observations, when performing Lesson 3.

Lesson 1
DETERMINE AND RECORD SURFACE PRESSURE

OBJECTIVE

Upon completion of this lesson, you will be able to determine and record surface pressure to the nearest 0.1 millibar using a barometer.

REFERENCES

This lesson is based on FM 6-15, TM 11-427, TM 11-6660-218-12, and other materials approved for US Army field artillery instruction; however, development and progress render the text continually subject to change. Therefore, base your examination answers on material presented in this lesson rather than on individual or unit experience.

1. INTRODUCTION. You will be trained in the use of electronic equipment and graphs for the gathering and recording of upper air weather data, which has its origin on the surface. In order to obtain accurate surface data, you must be able to read the barometer ML-102(*) and anemometer ML-433. The proper use of these instruments is essential for computing accurate meteorological (met) messages.

2. BAROMETERS.

a. Barometer ML-102(*). The barometer ML-102(*) (Fig 1) is the instrument used to measure surface pressure at the met section. Each field artillery met section is equipped with an aneroid barometer, which could be one of a number of different models. The major differences between these barometers are that the ML-102(D) model (Fig 1) has a wooden case, and the scale is graduated in millibars; whereas the ML-102(E) has a metal case, and the scale is graduated in millibars and inches of mercury. You will be working strictly with the millibars scale, so disregard the inches of mercury scale if you have that type of barometer. Since the following description and use are common to all models of the ML-102(*) barometer, from here on we shall simply call the instrument a barometer without reference to any particular model.

b. Aneroid cell. The barometer contains a small metal aneroid cell from which all but a small amount of air has been removed. The aneroid cell is sealed so that any changes in pressure of the air surrounding it will cause the cell to expand or contract. These small movements of the aneroid cell are magnified through a gear and linkage system that is graduated in units of pressure to show the pressure of the surrounding atmosphere.

c. Millibar scale. The millibar scale varies slightly depending on which model you have. On some models, the scale is graduated in half-millibar intervals and numbered every 10 millibars. On the other models, the scale is graduated in whole millibars and numbered every 5 millibars. All models have an outer millibar scale and an inner millibar scale. In addition to the scale, the dial also contains a mirror ring, which is used when reading the instrument.

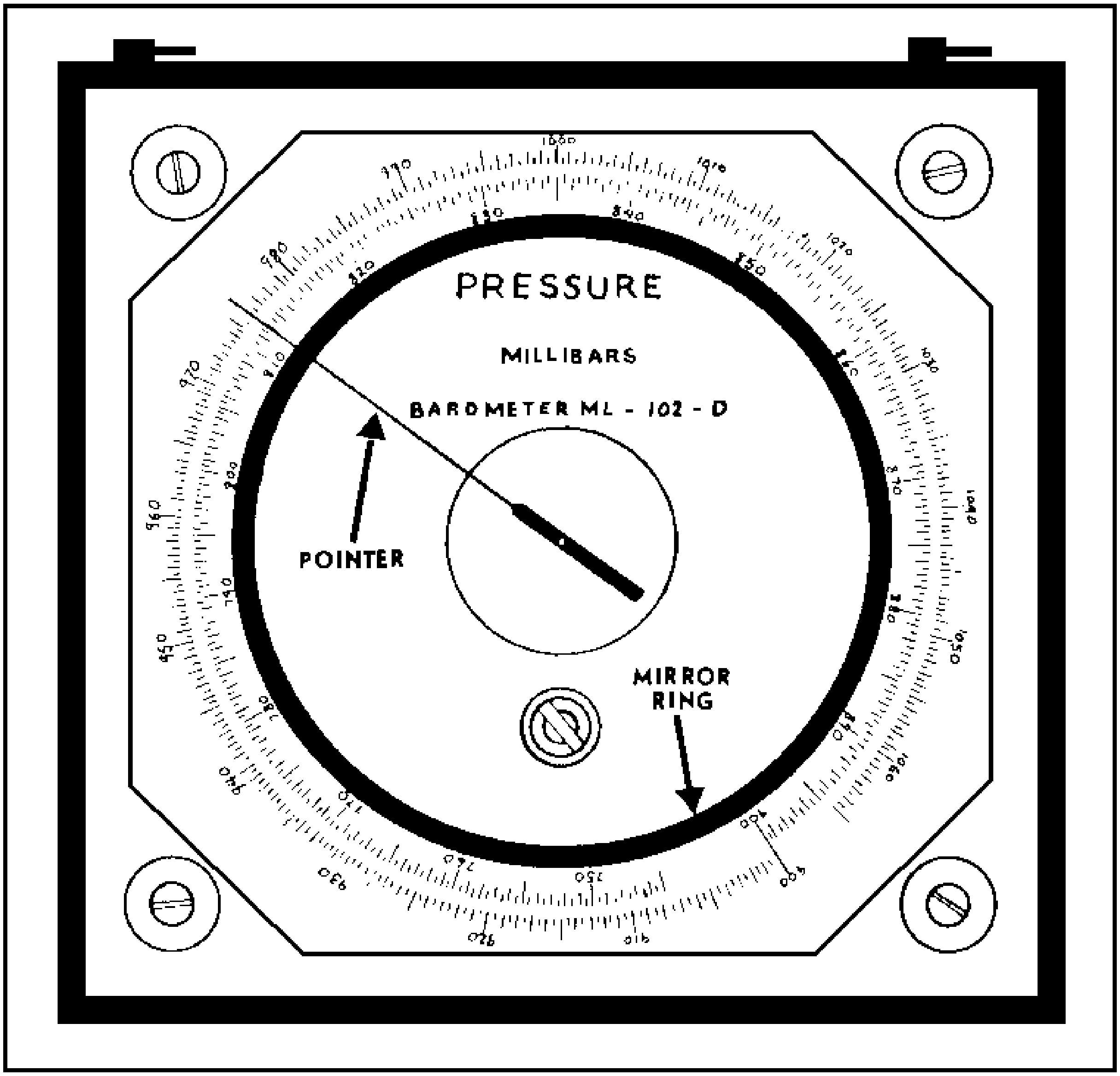


Figure 1. Barometer ML-102(D).

3. ACCURACY.

a. Aneroid barometer. A calibration check is required every 90 days to ensure the accuracy of the aneroid barometer. The calibration check is accomplished by comparing the aneroid barometer to a mercurial barometer normally found at the air weather service on the nearest Army airfield or the standard precision aneroid barometer ML-333 located with the corps ballistic met manager at the artillery element of the corps. If there is any discrepancy between the two barometers, the aneroid barometer is considered in error and is adjusted to the reading of the mercurial barometer or the standard barometer.

b. Pressure. The accuracy of the pressure indicated by the instrument is influenced primarily by the elasticity of the aneroid cell and the variations in temperature. However, when properly used, the aneroid cell is accurate to ±0.3 millibar.

c. Constant temperature. The barometer is usually installed indoors; however, if it is necessary to use the barometer outdoors, keep it in the shade and protect it from the wind. It must not be exposed to any heat source or to the direct rays of the sun. It must be placed in a location where the surrounding temperature remains constant.

d. Rapid change. If the barometer is transported by air or otherwise undergoes a rapid pressure change of 100 millibars or more, you must wait at least 24 hours before taking a reading. If the barometer undergoes a rapid temperature change of 50C or more, you must wait at least 1.5 hours before taking a reading. If a met message is required before the barometer can adjust itself to normal, the barometer may be used if mercurial barometric data are not available. However, you must make a notation on the met message that the ballistic densities may be in error.

4. READING THE BAROMETER.

a. Correct scale. Determining which of the millibar scales to read is a simple process. Assume that every 10 meters of height is equal to approximately 1 millibar. By knowing the height of your station, you can determine the correct scale to use.

EXAMPLE: Your station elevation is 360 meters

Divide station height in meters by 10

$$\frac{360}{10} = \text{approximately 36 millibars}$$

Standard mean sea level pressure		1013.25 millibars
(-) Height of station in millibars	-	36 millibars

		977.25 millibars

Therefore, you would select the scale that indicates 977 millibars and read the station pressure as shown by the pointer.

NOTE: When the station height is above sea level, you subtract the millibar equivalent; when the station is below sea level, you add it.

b. Pointer. Just before you read the pressure indicated on the barometer, tap lightly on the plastic window over the dial to ensure that the pointer is free to move. For accurate results, your eye must be in a position directly over the pointer (Fig 2), so that the pointer obscures its own reflection in the mirror ring. This ensures that you are looking at the dial correctly and not from one side or the other. Take the pressure reading to the nearest 0.1 millibar.

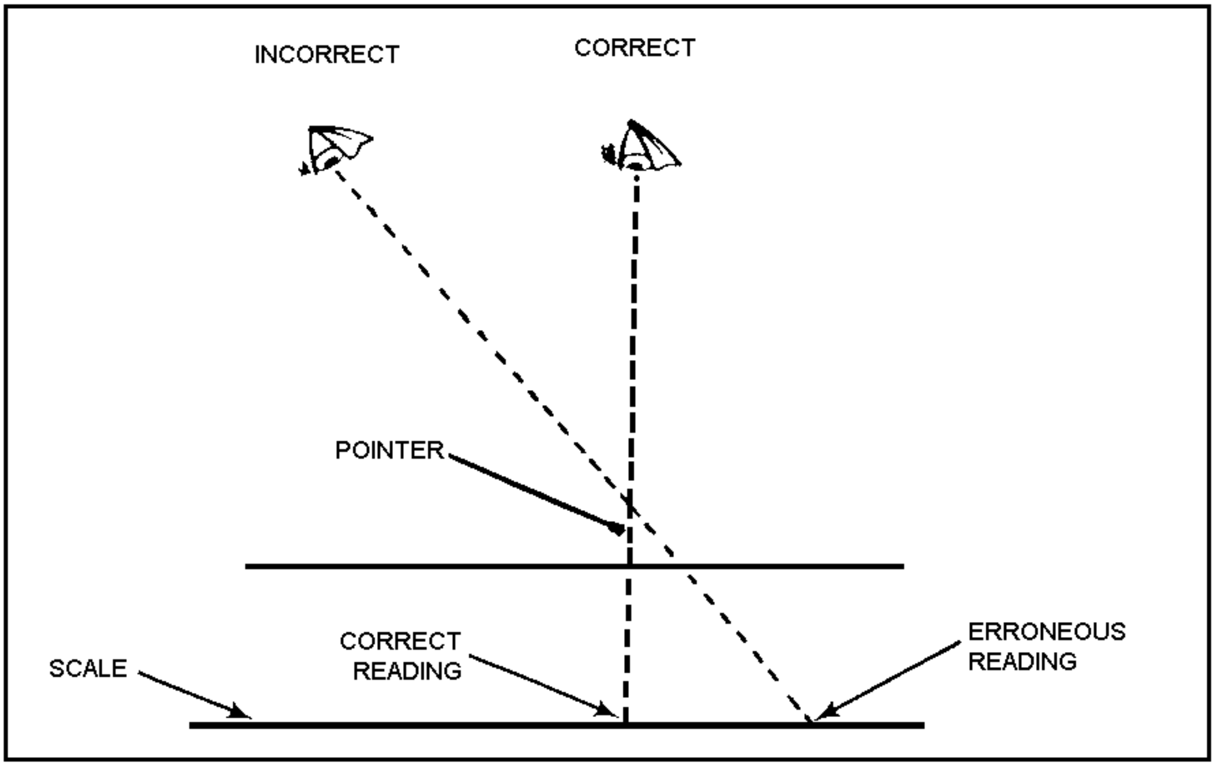
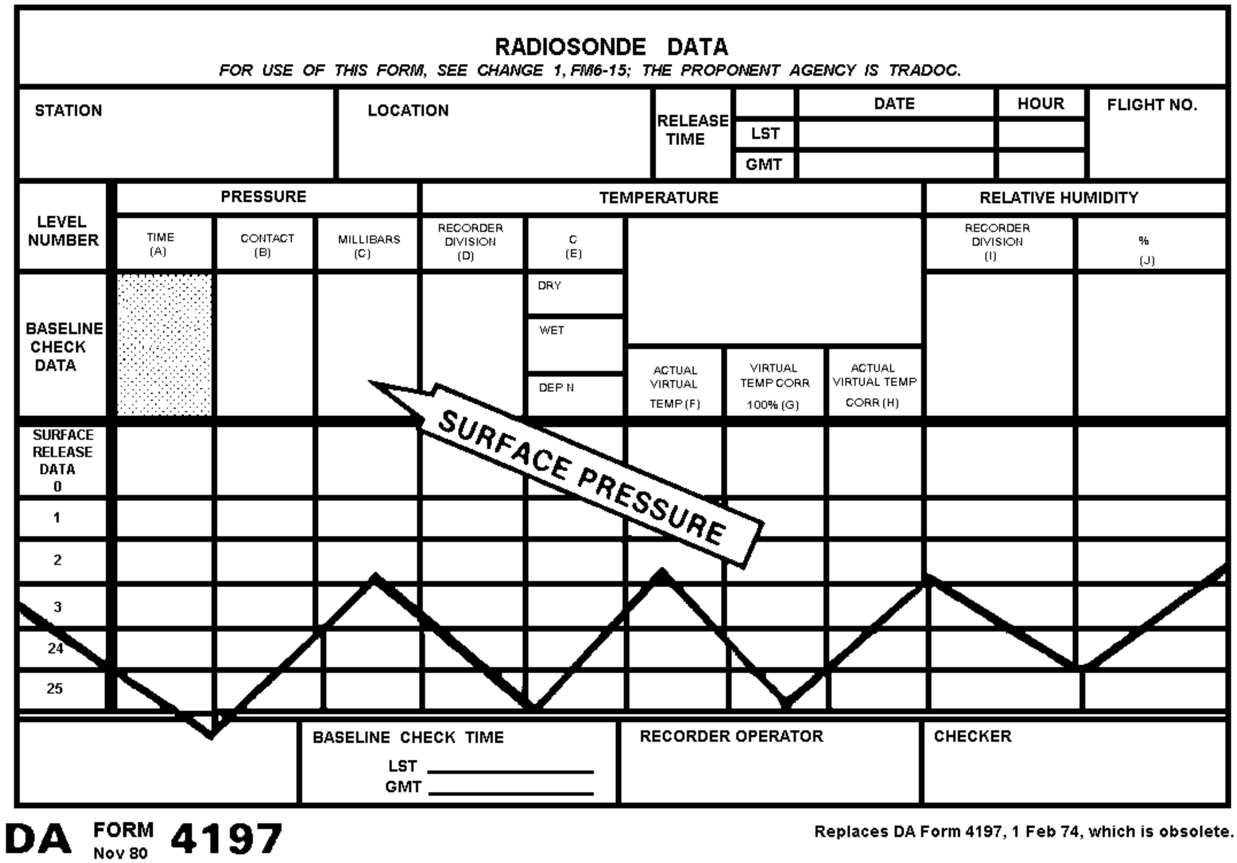


Figure 2. Reading the barometer.

c. Record pressure. After reading the pressure to the nearest 0.1 millibar, record the pressure on DA Form 4197 (Radiosonde Data sheet) in block (C) (Fig 3).


RADIOSONDE DATA
FOR USE OF THIS FORM, SEE CHANGE 1, FM6-15; THE PROPONENT AGENCY IS TRADOC.

STATION | LOCATION | RELEASE TIME | LST | GMT | DATE | HOUR | FLIGHT NO.

LEVEL NUMBER | PRESSURE: TIME (A), CONTACT (B), MILLIBARS (C) | TEMPERATURE: RECORDER DIVISION (D), C (E), DRY, WET, DEP N, ACTUAL VIRTUAL TEMP (F), VIRTUAL TEMP CORR 100% (G), ACTUAL VIRTUAL TEMP CORR (H) | RELATIVE HUMIDITY: RECORDER DIVISION (I), % (J)

BASELINE CHECK DATA
SURFACE RELEASE DATA 0
1
2
3
24
25

BASELINE CHECK TIME
LST
GMT
RECORDER OPERATOR
CHECKER

DA FORM 4197 Nov 80
Replaces DA Form 4197, 1 Feb 74, which is obsolete.

Figure 3. Radiosonde data sheet.

PRACTICE EXERCISES:

Complete the following exercises by circling T for true or F for false, circling the letter preceding the correct answer, or filling in the blanks, as appropriate. Be sure to complete the practice exercises as they appear. They are "building blocks" and will help you complete the rest of the subcourse successfully. The answers follow the last exercise and are separated by rows of slashes (////). If any of your answers are incorrect, restudy the appropriate part of the subcourse before you continue.

1. The scales on the aneroid barometer are graduated in _____________ and/or ____________________ _____ ______________________.

2. The barometer is considered to be accurate to within ± __________ millibar(s).

3. If the barometer undergoes a rapid pressure change, you should wait at least _________ hours before taking a reading.

4. Which millibar scale should you read if your station height is 450 meters above sea level?

a. inner scale.
b. outer scale.

5. Using the outer scale in Figure 1, read the pressure and record it. If you will print the form below you may use it to record your answer.

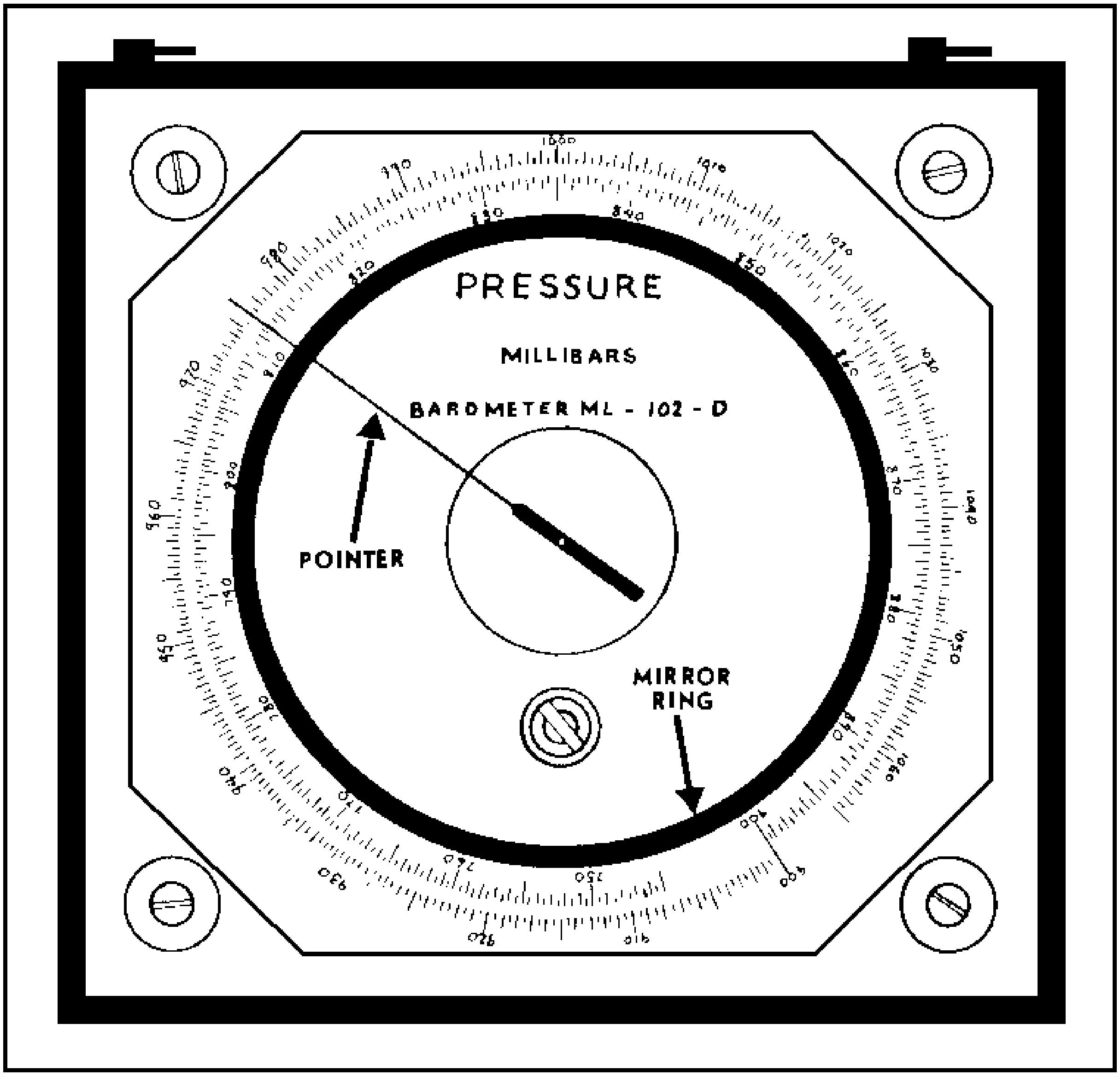
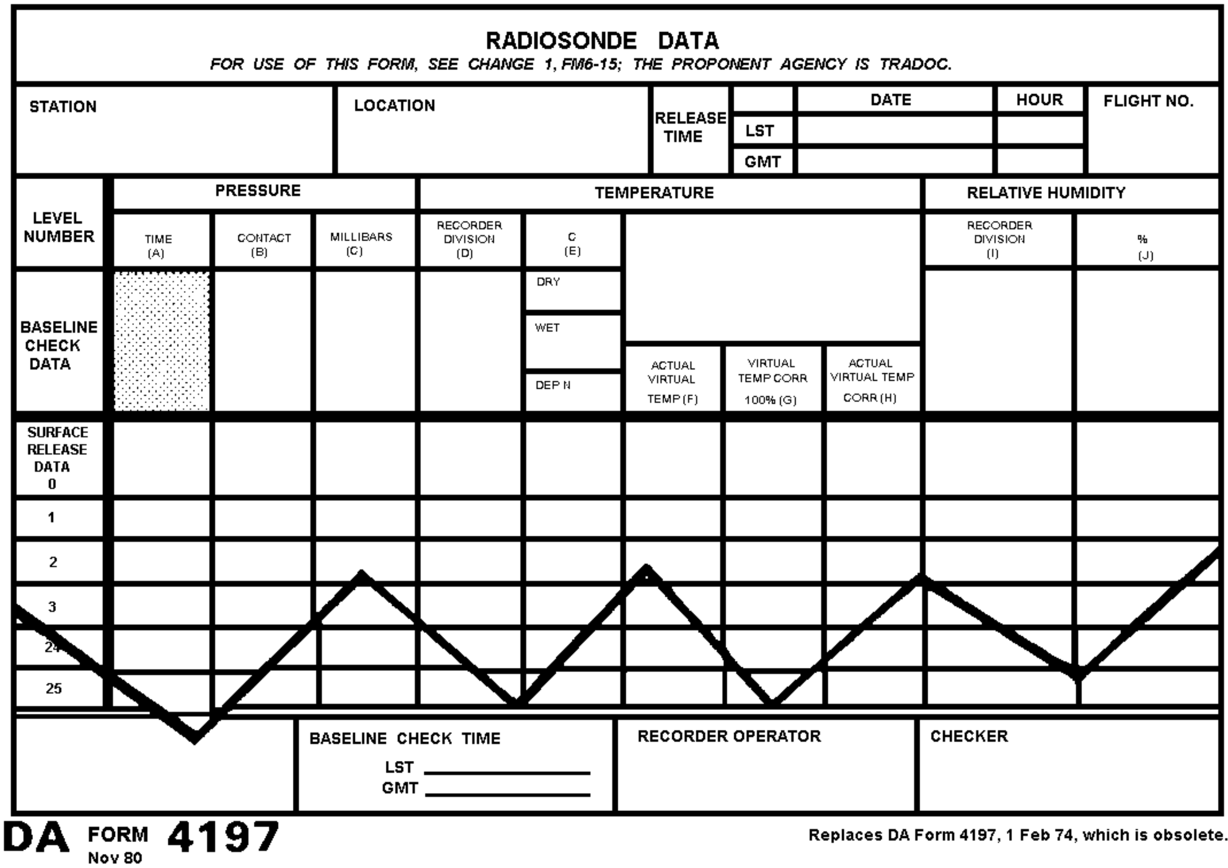


Figure 1. Barometer ML-102(D).



RADIOSONDE DATA

FOR USE OF THIS FORM, SEE CHANGE 1, FM6-15; THE PROPONENT AGENCY IS TRADOC.

STATION	LOCATION	RELEASE TIME		DATE	HOUR	FLIGHT NO.
			LST			
			GMT			

LEVEL NUMBER	PRESSURE			TEMPERATURE						RELATIVE HUMIDITY	
	TIME (A)	CONTACT (B)	MILLIBARS (C)	RECORDER DIVISION (D)	C (E)	ACTUAL VIRTUAL TEMP (F)	VIRTUAL TEMP CORR 100% (G)	ACTUAL VIRTUAL TEMP CORR (H)		RECORDER DIVISION (I)	% (J)
BASELINE CHECK DATA					DRY / WET / DEP N						
SURFACE RELEASE DATA 0											
1											
2											
3											
24											
25											

	BASELINE CHECK TIME	RECORDER OPERATOR	CHECKER
	LST ____ GMT ____		

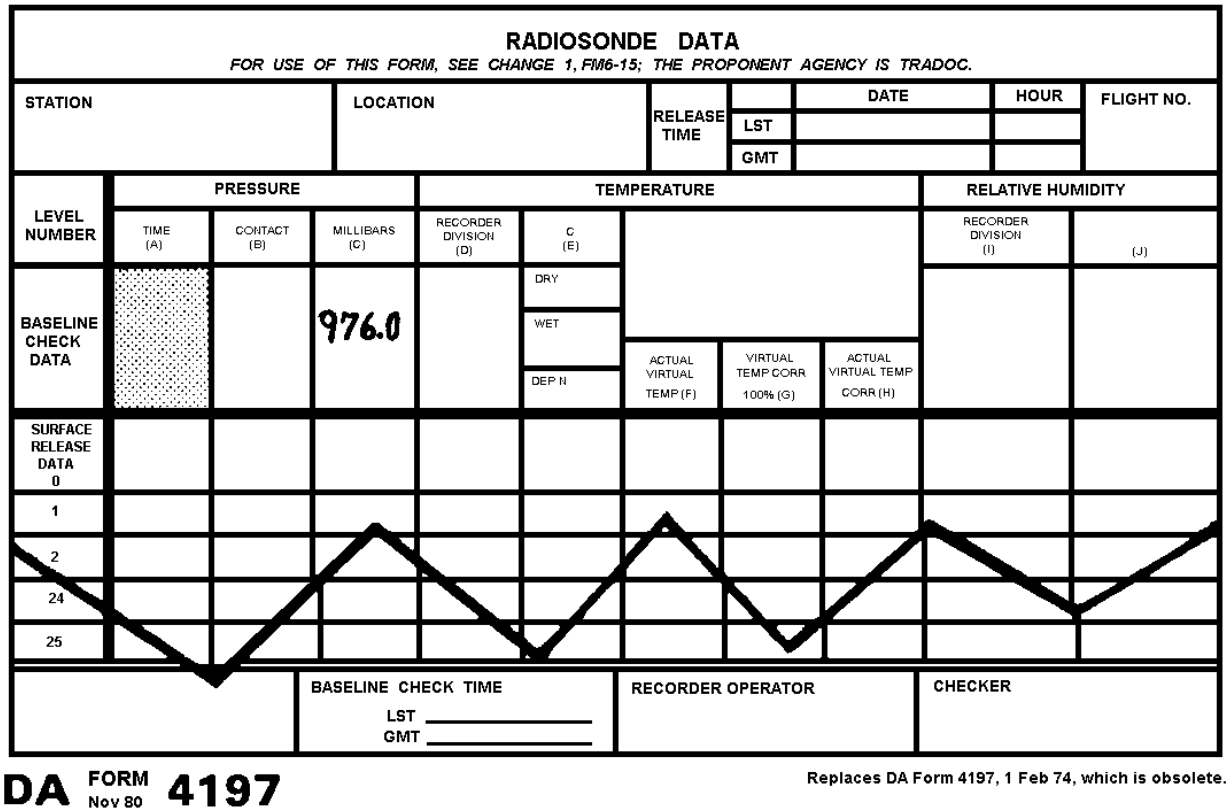
DA FORM 4197 Nov 80 — Replaces DA Form 4197, 1 Feb 74, which is obsolete.

ANSWERS:

1. millibars, inches of mercury.
2. 0.3 millibar
3. 24
4. b. Standard mean sea level pressure 1013.25 millibars
   Height of station in millibars - 45 millibars
   968.25 millibars

Therefore, you would select the outer scale that indicates 968 millibars.

5. 976.0



RADIOSONDE DATA

FOR USE OF THIS FORM, SEE CHANGE 1, FM6-15; THE PROPONENT AGENCY IS TRADOC.

STATION	LOCATION	RELEASE TIME		DATE	HOUR	FLIGHT NO.
			LST			
			GMT			

LEVEL NUMBER	PRESSURE			TEMPERATURE					RELATIVE HUMIDITY	
	TIME (A)	CONTACT (B)	MILLIBARS (C)	RECORDER DIVISION (D)	C (E)				RECORDER DIVISION (I)	(J)
BASELINE CHECK DATA			976.0		DRY / WET / DEP N	ACTUAL VIRTUAL TEMP (F)	VIRTUAL TEMP CORR 100% (G)	ACTUAL VIRTUAL TEMP CORR (H)		
SURFACE RELEASE DATA 0										
1										
2										
24										
25										

	BASELINE CHECK TIME	RECORDER OPERATOR	CHECKER
	LST ____ GMT ____		

DA FORM 4197 Nov 80 Replaces DA Form 4197, 1 Feb 74, which is obsolete.

5. SUMMARY. The barometer is essential to the met section's operation. Without proper calibration, positioning, maintenance, and use of the barometer, weather data provided by your section will be invalid and of no use to the supported units.

Lesson 2
DETERMINE AND RECORD SURFACE WIND SPEED AND DIRECTION

OBJECTIVE

Upon completion of this lesson, you will be able to determine the surface wind speed to the nearest knot and direction to the nearest degree.

REFERENCES

This lesson is based on FM 6-15, TM 11-6660-218-12, and other materials approved for US Army field artillery instruction; however, development and progress render the text continually subject to change. Therefore, base your examination answers on material presented in this lesson rather than on individual or unit experience.

6. ANEMOMETER ML-433.

a. Purpose. The purpose of the anemometer ML-433 is to provide a means for measuring the surface wind direction and surface wind speed. The anemometer (Fig 4) consists of four major

components--a wind vane and cover; a velometer, which measures wind speed; a compass, which indicates wind direction; and a removable handle.

b. Wind vane. The wind vane on top of the anemometer is movable and is acted upon by the wind just like any other wind vane. An index pin is mounted in a fixed position on the instrument case. When the index pin is aligned with the index mark on the wind vane, the instrument is properly aligned with the wind. A wind vane cover is attached to the instrument by a small chain and is used to cover the wind vane when the anemometer is not in use.

c. Velometers. The velometer is located directly beneath the wind vane (Fig 4). This is the part of the instrument that measures the speed of the wind. It contains the wind speed scale and pointer. The scale is graduated in knots.

d. Wind scale. The wind scale is divided into an upper scale and a lower scale. The upper scale measures wind speeds from 0 knots to 40 knots. The lower scale measures wind speeds from 0 knots to 8 knots. You select the scale to be used by means of the knurled range selection knob located on the left side of the velometer. If there is not much wind, set the range selector so that you read the speed of the wind on the 0- to 8-knot scale. If the wind is blowing hard, position the range selector so that you read the 0- to 40-knot scale.

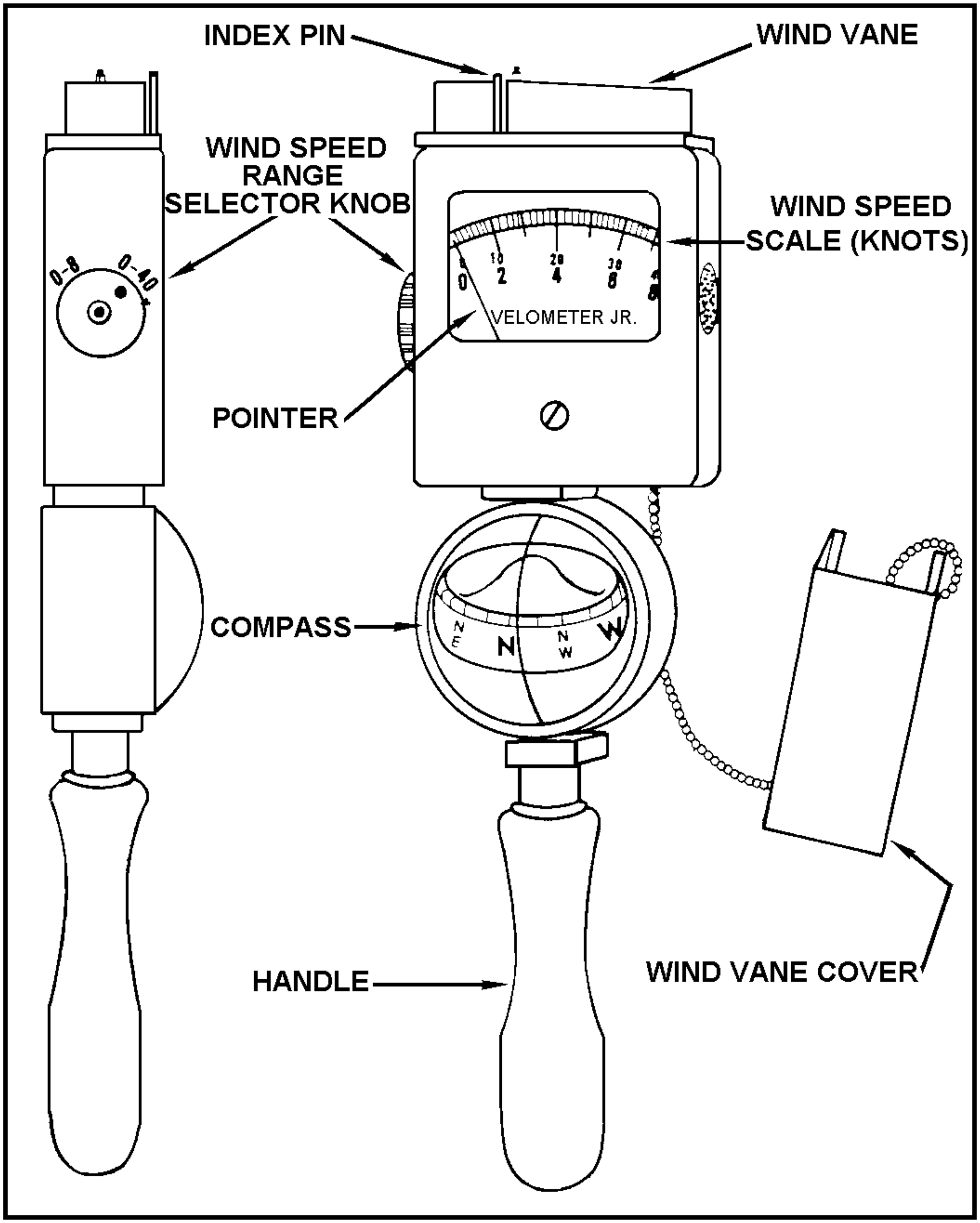


Figure 4. Anemometer ML-433.

e. Vent. You will notice a vent in the center of the range selector knob. This vent allows the wind to blow into the velometer. On the opposite side of the velometer, you will notice another vent. This vent permits the wind to blow completely through the velometer and activates the pointer so that you can read the speed of the wind on the scale.

f. Compass. The compass, which is located below the velometer, indicates the direction from which the wind is blowing. There are two models of anemometers. One model is read to 16 points of the compass, while the other model can be read to the nearest 5^0. By reading the compass, you determine the magnetic direction of the wind.

7. DETERMINING DIRECTION.

a. Direction. To determine the direction of the wind, hold the anemometer in an upright position at approximately eye level and at arm's length from your body (Fig 5). Be sure that the wind vane cover is removed. Stand so that the wind is blowing from your left. Slowly turn the anemometer clockwise and counterclockwise until the index mark on the wind vane is aligned with the index pin. Now you can read directly from the compass the magnetic direction from which the wind is blowing.

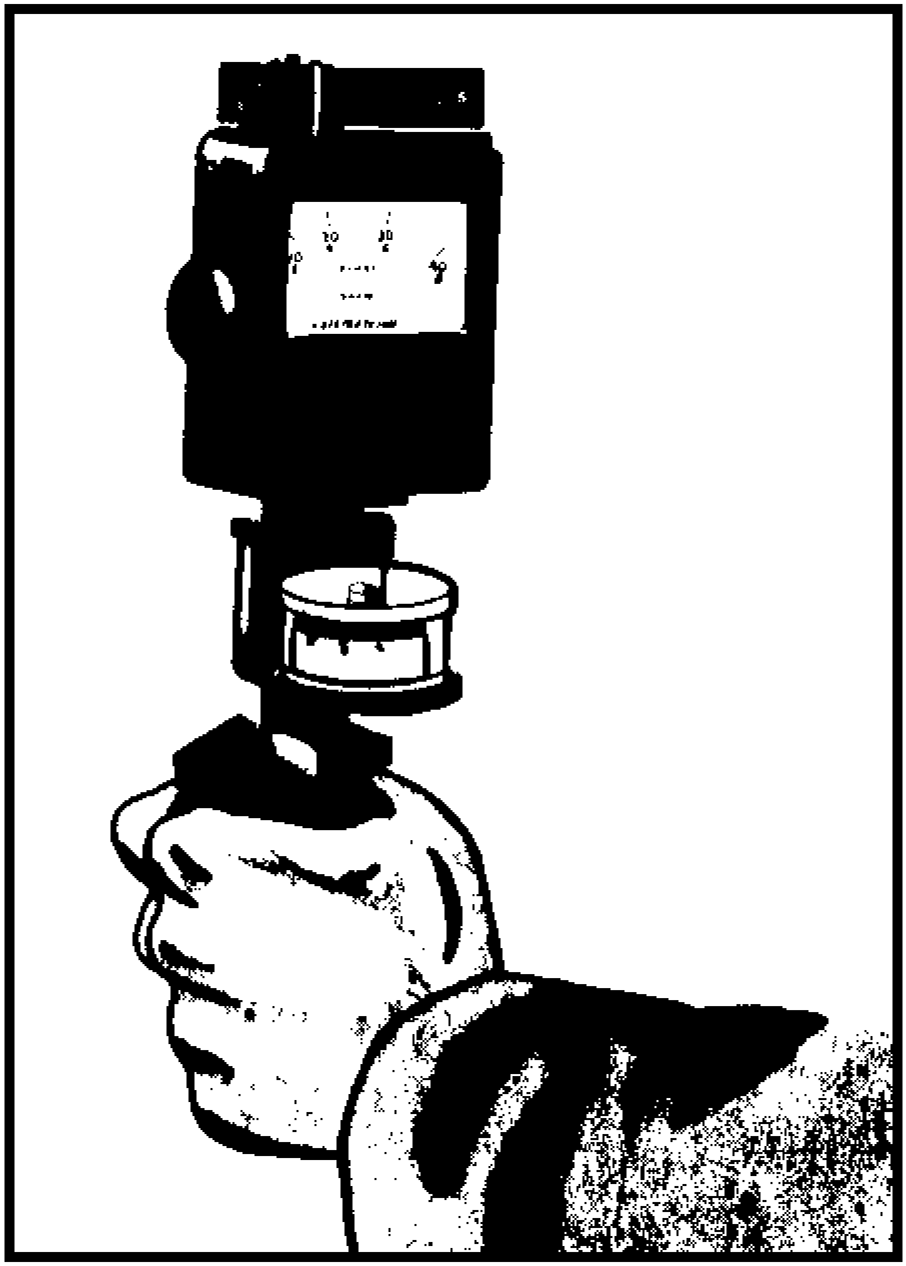


Figure 5. Reading anemometer.

b. Extreme readings. If the compass readings are erratic because of variable winds, you must read the average of the two extreme compass readings to determine the wind direction.

EXAMPLE: One extreme reading = W (West)

The other extreme reading = NW (Northwest)

Average reading = WNW (West-Northwest)

c. Conversion. When you have determined the direction of the wind, you must convert it to degrees. If you are using the anemometer on which the compass is graduated to 16 points of the compass, use the diagram in figure 6.

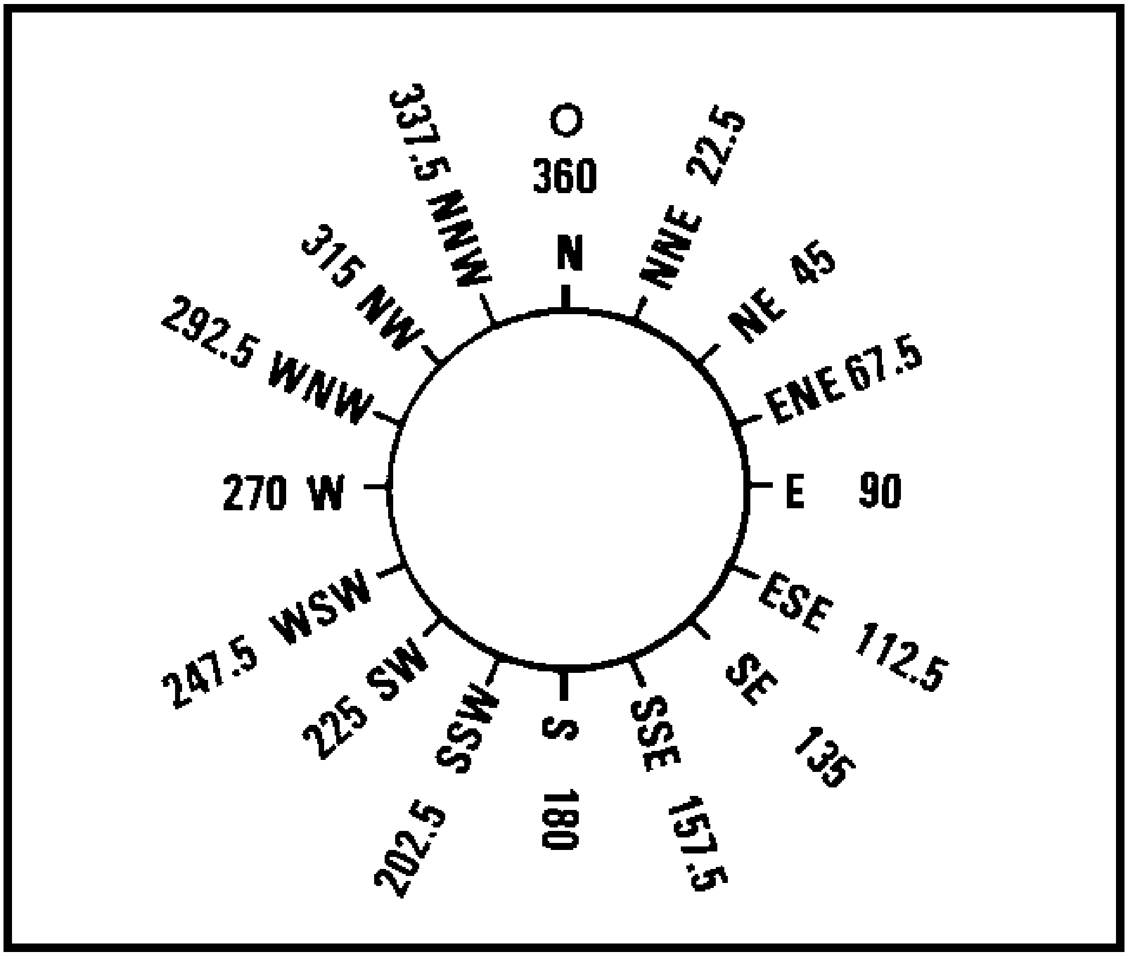


Figure 6. Conversion of points of compass to degrees.

EXAMPLE: Anemometer reading = East
Wind direction in degrees = 90^0

After you have determined the wind direction in degrees, you must convert it to a true direction (based on true north instead of magnetic north). To do this, you apply the magnetic declination for the area in which you are located to the magnetic direction. The magnetic declination is shown in

the declination diagram on the map of the area. Remember the P E W S rule when applying the magnetic declination (Plus East, West Subtract).

EXAMPLE: Anemometer reading	=	90^0 or East
Magnetic declination	=	$+ 7.2^0$ East

Wind direction	=	97.2^0

Round off the wind direction to the nearest degree. Therefore, in the above example, 97.2 rounds to and is recorded as 97. Had the magnetic declination been west 7.2 in the above example, then:

Anemometer reading	=	90^0
Magnetic declination	=	$- 7.2^0$
Wind direction	=	82.8^0 or 83^0

8. DETERMINING WIND SPEED. The first step in obtaining wind speed is to set the range selector to the appropriate wind speed scale: 0-8 for gentle winds or 0-40 if the wind is blowing hard. Without changing the position in which you hold the anemometer to read the wind direction, read the wind speed to the nearest knot on the velometer (Fig 5). When reading the velometer, you must view the scale and pointer straight on or you may report an erroneous reading. If the pointer fluctuates considerably, read the highest and the lowest wind speeds indicated on the scale and average them.

EXAMPLE: Highest reading	24
Lowest reading	+13
Sum	37
Half the sum	18.5 = 18 knots

PRACTICE EXERCISES:

6. The purpose of the anemometer ML-433 is to provide a means for measuring--

 a. upper atmospheric wind direction and speed.
 b. surface wind direction and speed.
 c. barometric pressure.
 d. surface temperature.

7. T F When the index pin is aligned with the index mark on the wind vane, the instrument is properly aligned with the wind.

8. If the winds are variable, you select the--

 a. first reading.
 b. second reading.
 c. average of two readings.
 d. highest reading.

9. You must convert the wind direction from a magnetic direction to a true direction by applying the--

a. G-M angle.
b. grid declination.
c. magnetic declination.
d. true declination.

10. You are measuring the surface wind direction with the anemometer, and the direction, which you read, is northeast. What would the wind direction be if your magnetic declination is 15^0 east?

a. 30^0
b. 45^0
c. 60^0
d. 85^0

ANSWERS:

6. b.
7. T
8. c.
9. c.
10. c.

9. SUMMARY. For the anemometer to perform its intended function of measuring wind speed and direction at the met station, it must be maintained and cared for as any other delicate instrument. After using the anemometer, return it to its designated place of storage to prevent damage.

Lesson 3
PERFORM AND RECORD A LIMITED SURFACE OBSERVATION

OBJECTIVE

Upon completion of this lesson, you will be able to perform a limited surface observation and record all pertinent information on DA Form 5033-R (Limited Surface Observation).

REFERENCES

This lesson is based on FM 6-16-2; however, development and progress render the text continually subject to change. Therefore, base your examination answers on material presented in this lesson rather than on individual or unit experience.

10. LIMITED OBSERVATIONS.

a. Increased met support. With the new equipment and weaponry, the meteorological needs of the US Army have increased significantly over the past 10 years. Systems such as Copperhead, multiple launch rocket system, remotely piloted vehicle, Firefinder, and meteorological data system AN/TMQ-31 will all require increased met support.

b. Responsibility. The responsibility to provide surface and upper air weather observations in the area forward of division command elements for Army artillery, engineers, intelligence, aviation, and medical units has always been placed on the US Army.

c. Mission. The mission of the field artillery met section has been expanded to include taking and recording a limited surface observation, which adds information that the electronic or visual message does not include. To assist the US Army FA met crewmember in taking this surface observation, the supplementary surface weather report (SUPRP) code has been adopted. The SUPRP is a standard North Atlantic Treaty Organization (NATO) code developed to be used by nonweather people, usually with little or no weather observing equipment and with only limited weather training. The armed forces of NATO countries have agreed to adopt the message format so that one country can develop a message that can be used by all countries in NATO.

d. Repetition. It is understood that in some areas of the code, additional information may seem repetitious. Cloud information and surface winds, for example, both have additional amplification groups. Because of varied weather requirements of the many new systems, both identified and anticipated, only surface data will be considered an optional group.

11. DA FORM 5033-R. DA Form 5033-R (Fig 7) is used to record limited surface observation. It consists of 6 lines and 26 blocks of information. The ACTUAL CONDITIONS blocks on lines 1, 3, and 5 are used to record the actual surface conditions during the observation. The SUPRP blocks on lines 2, 4, and 6 are used to record the encoded information with the use of tables provided for that purpose after the observation has been made. DA Form 5033-R has an identifier line above each block of information. This form is to be locally reproduced by the using unit, thus the R after 5033.

	LIMITED SURFACE OBSERVATION FOR USE OF THIS FORM, SEE FM 6-16-2; the proponent agency is TRADOC							DATE		
	IDENTIFIER	OCTANT Q a	LATITUDE LaLaLa b	LONGITUDE LoLoLo c	DATE (GMT) YY d	TIME (GMT) GGgg e	TOTAL AMOUNT OF CLOUD COVER Na (Table 4-1) f	WIND DIRECTION D (Table 4-2) g	WIND SPEED F (Table 4-3) h	VISIBILITY V (Table 4-4) i
1	ACTUAL CONDITIONS									
2	SUPRP									
	IDENTIFIER	PRESENT WEATHER w (Table 4-5) j	AMPLIFICATION OF PRESENT WEATHER A (Table 4-6) k	STATION HEIGHT HHH l	ROAD CONDITIONS R (Table 4-7) m	TERRAIN CONDITIONS T (Table 4-8) n	STATE OF WATER SURFACE A (Table 4-9) o	AIR TEMPERATURE TT p	PRESSURE PPPP q	WIND DIRECTION dd r
3	ACTUAL CONDITIONS									
4	SUPRP									
	IDENTIFIER	WIND SPEED ff s	AMOUNT OF LOWEST CLOUD Nh (Table 4-10) t	HEIGHT OF LOWEST CLOUD ha (Table 4-11) u	INDICATION FOR SURF DATA 99 v	AVERAGE HEIGHT OF BREAKERS (METERS) Hs (Table 4-12) w	PERIOD OF BREAKERS (SECONDS) Ps (Table 4-13) x	DIRECTION OF WAVES Dw (Table 4-14) y	WIDTH OF SURF ZONE Ws (Table 4-15) z	
5	ACTUAL CONDITIONS				99					
6	SUPRP				99					
	REMARKS									
									DA FORM 5033-R, Dec 81 L 3776 Army-Fort Sill, Okla.	

Figure 7. DA Form 5033-R.

12. SUPRP CODE (SYMBOLIC BREAKDOWN). The limited surface observation procedure (LSOP) message will be transmitted in six-digit groups. The order of groups must be maintained. Only the 99 group will be considered optional and may be omitted if not applicable. The group is used when located near a body of water. If an element within a group cannot be reported, it must be entered as a slash (/). The symbolic identifier is located on each block just below the title (see Fig 7). The symbols of the code and the order of transmittal are listed below.

SUPRP Code identifier (indicate SUPRP met message to follow).

Q Octant of the globe. Same as artillery met.

LaLaLa Latitude.

LoLoLo Longitude.

NOTE: When a coded location is desirable, the Q, latitude, and longitude will be an arbitrary number of digits to specify position, which must be understood by the receiving unit.

YY Day of month, Greenwich mean time (GMT).

GGgg Time of observation (GMT).

Na Total amount of cloud cover (Table 4-1).

D Direction of surface wind (Table 4-2).

F Force of surface wind (Table 4-3).

V Visibility at surface (Table 4-4).

w Present weather (Table 4-5).

A' Amplification of phenomenon reported by w (Table 4-6).

HHH Height of station.

R State of road in vicinity of the observation point (Table 4-7).

T State of terrain prevailing in the vicinity of the observation point (Table 4-8).

A State of water surface (Table 4-9).

TT Air temperature in whole degrees Celsius.

PPPP Pressure at the observation point.

dd Direction from which surface wind is blowing. This group will be reported as 99 when the wind speed is less than 5 knots.

ff Wind speed in knots.

Nh Amount of cloud reported at height ha (Table 4-10).

ha Height of lowest cloud layer observation point (Table 4-11).

[99] Indicator for surf data (when applicable).

[Hs] Average height of breakers in meters (Table 4-12).

[Ps] Period of breakers in seconds (Table 4-13).

[Dw] Direction of wave's approach to beach with observer's back to the sea (Table 4-14).

[Ws] Width of surf zone in meters (Table 4-15).

13. INSTRUCTIONS FOR TAKING SURFACE WEATHER OBSERVATIONS.

a. SUPRP--message identifier. Use the five-letter SUPRP message identifier already printed on the form. The identifier line (Fig 7) includes a plain language (octant, time, etc.) heading and a symbolic letter heading.

EXAMPLE: You are located at Fort Sill, Oklahoma.

Octant = 1
Actual conditions = 1
SUPRP code = 1

b. Q--octant. The digit under the symbol Q (Fig 8) represents the global octant in which the section is located. For convenience in determining the geographical location of the met station, the globe has been arbitrarily divided into octants numbered 0 through 8 (4 is not used). When the next group of six digits is a coded location, 9 is used for the octant space. To obtain the octant, refer to the extract on page A-1

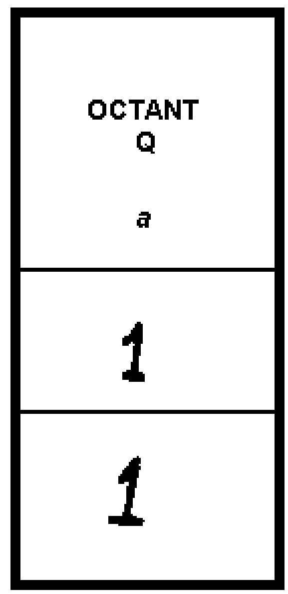


Figure 8. Octant.

c. LaLaLaLoLoLo--station location. In the second six-digit group (Fig 9), three numbers are for latitude and three are for longitude to one-tenth of a degree. If the longitude is over 100^0, the first digit is dropped. When the location must be coded, the code is an agreement with the receiving and transmitting units.

LATITUDE LaLaLa b	LONGITUDE LoLoLo c
347	984
347	984

Figure 9. Location.

EXAMPLE: At Fort Sill, Oklahoma
Latitude = 34^0 42'
Longitude = 98^0 24'

To convert the minutes to tenths of degrees, the minutes are divided by 6.

42'÷6 = 7 and 24'÷6 = 4

Actual conditions = 347 984
SUPRP code = 347 984

If the minutes are not an even multiplier of 6, use the artillery round-off rule to determine what to encode.

EXAMPLE: 45' is halfway between 42' and 48'

42'÷6 = 7 and 48' ÷ 6 = 8

In this case, you would use 8, since it is an even number and 7 is not.

d. YYGGgg--date and time. The third six-digit group (Fig 10) is used for the date and time. Both are given in Greenwich mean time (GMT) in hours and minutes at the time of observation. To obtain the time difference from the local standard time, refer to the extract on page A-1.

EXAMPLE: The observation was taken at 2015. From the extract, we obtain a difference from GMT for Fort Sill of +7 hours.

Therefore: 2015 Local standard time (LST)
+700 GMT correction
2715
-2400
0315 GMT time (next day)

Notice that 2715 is not used, since there are only 24 hours in a day.

The date is 19 March 1984.

Date = 19 LST
20 GMT
Time = 2015 LST
0315 GMT

DATE (GMT) YY d	TIME (GMT) GGgg e
20	0315
20	0315

Figure 10. Date and time.

Notice that the date changed to 20, since the GMT time is over 24 hours.

e. Na--sky condition. Of all the weather conditions that adversely affect aircraft/flying operations, low clouds and low visibility are by far the most common. The following information describes the method for observing sky conditions.

(1) General. Sky condition observations consist of two elements:

(a) The total amount of clouds or obscuration present.

(b) Remarks about the sky condition in the area which would be helpful to the weather forecaster or to the aviator.

(2) Sky cover amounts (Na).

(a) The total amount of the sky covered by clouds or an obscuration can be described by using one of the following words:

- Clear. Less than one-eighth of the sky is covered by clouds.
- Scattered. One-eighth to less than one-half of the sky is covered (approximately 10 to 50 percent).
- Broken. One-half or more of the sky is covered (approximately 60 to 90 percent).
- Overcast. The sky is totally covered by clouds or obscuring phenomena (e.g., fog, blowing snow, blowing sand, or smoke).

(b) Determine the total cloud amount by considering the sky above you as a celestial dome and mentally dividing it into eight equal parts. For example, you are the observer standing at point X in Figure 11. There are three different cloud layers in the sky above you. Here you have 6/8 cloud cover.

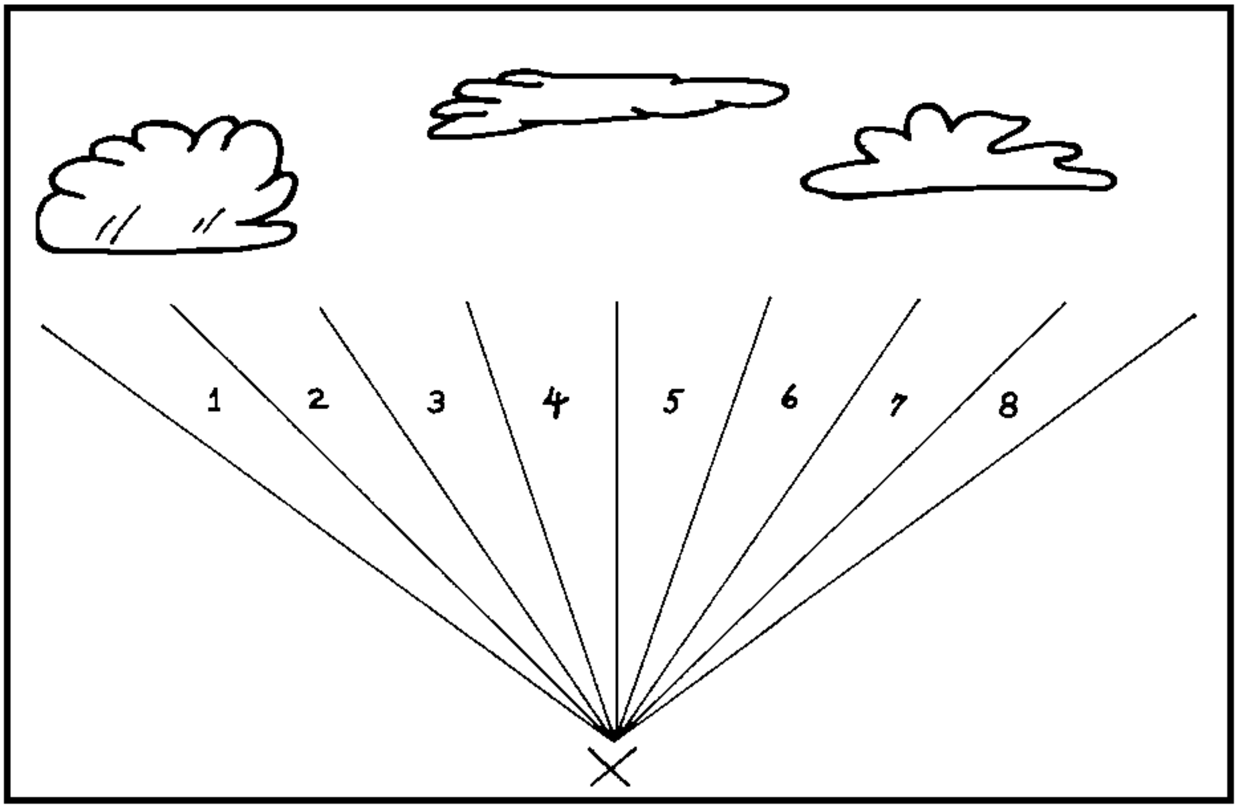


Figure 11. Cloud cover estimation.

To obtain the total amount of cloud cover code, refer to Table 4-1 of the extract on page A-2.

EXAMPLE: clouds cover Three-eighths of the sky dome.

Actual conditions = SCTD
SUPREP code = 2 (Fig 12)

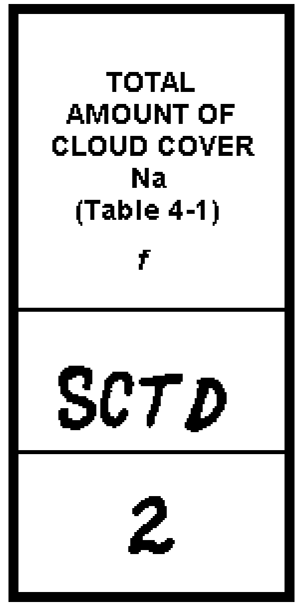


Figure 12. Cloud cover.

(c) Very often, significant features of the sky cover cannot be described simply as scattered, broken, etc. Explanations for hilly or mountainous stations are included in the code and must be used. These codes are extremely important to aircraft operations.

f. D and F--wind direction and speed. Wind direction (D) and speed (F) (Fig 13) are necessary in forecasting weather, especially in locations where weather is often associated with frontal systems. Wind direction and speed can be used to locate these fronts and to determine their movement. Frequently, the combination of wind direction and terrain produces significant variation in wind speed over very short distances. Local variations in wind speed can also produce deviations from the normal in weather conditions.

(1) Direction (D). Wind direction is defined as the direction from which the wind is blowing. Wind direction may be measured from a direct reading of the hand-held anemometer ML-433.

(2) Speed (F). Wind speed may also be read from a direct reading of the hand-held anemometer ML-433. If no wind equipment is available, the speed may be estimated by using Table 4-3 of the extract on page A-3.

EXAMPLE: From the anemometer ML-433, you obtain a wind direction of south equivalent to 180^0 after you apply the magnetic declination and a wind speed of 15 knots.

WIND DIRECTION D (Table 4-2) k	WIND SPEED F (Table 4-3) h
180	15
4	4

Figure 13. Direction and speed.

To obtain the wind direction and speed code, refer to Tables 4-2 and 4-3 of the extract on pages A-2 and A-3.

Actual conditions = 180^0 (direction)

15 knots (speed)

SUPRP CODE = 4

g. V--visibility. Visibility is an important limiting factor in flying operations.Poor visibility restricts visual surveillance and flying observations.

(1) Visibility is the greatest known distance an object can be seen and identified by the normal eye without the aid of optical devices such as binoculars and starlight scope. In actual practice, visibility is the greatest known distance that prominent objects such as trees, buildings, water towers, or natural landmarks (hills) can be seen clearly enough to be identified.

(2) In daytime, any building, water tower, telephone pole, road, hill, clump of trees, etc. that can be seen under ideal conditions may be used as a visibility marker if the distance to the object is known.

(3) At night, the above objects can be used if their silhouettes can be identified. However, the best nighttime marker is an unfocused light at a known distance from the observation point. (This

does not include searchlights, airport rotating beacons, or automobile headlights aimed directly at you.)

(4) The visibility that is reported must be representative of at least one-half of the horizon circle. In making this determination, the horizon circle is normally divided into quadrants as shown in Figure 14. Any two quadrants (they need not be continuous) may be used to determine prevailing visibility. Visibility is reported in meters, to the nearest hundred, as listed in Table 4-4. In some instances, the code figure is reported one digit less than the one actually extracted from the table.

EXAMPLE: You determine visibility to be 600 meters. If you report code Figure 3, then the person receiving the message will assume that he can see up to 1,000 meters, since those are the limits for code figure 3 on Table 4-4. Therefore, it is best to report code figure 2 in order to be safe (Fig 15).

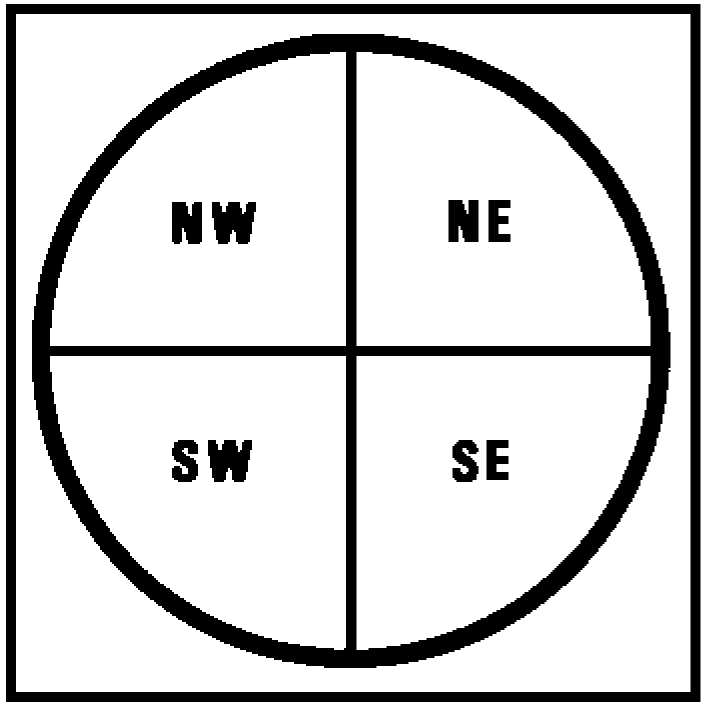


Figure 14. Quadrant visibility.

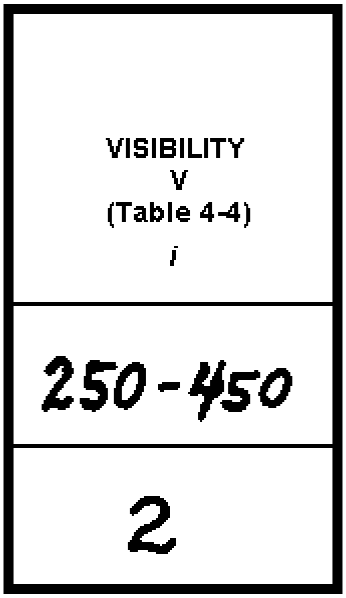


Figure 15. Visibility.

(5) Quadrant visibility may be reported as a remark at the end of the observation. If you believe that the visibility in one quadrant is significantly different from prevailing visibility, you should include a remark.

EXAMPLE: You determine visibility to be between 250 and 450 meters. To obtain the visibility code, refer to Table 4-4 of the extract on page A-3.

Actual conditions = 250 - 450
SUPRP code = 2

h. W--weather and obstructions to vision. We have already mentioned the important effect that visibility has on operations. It would not be logical to report a reduction in visibility without describing it in terms of the weather phenomena upon which visibility depends. These weather phenomena are divided into two main groups: weather and obstructions to vision. They are discussed separately in detail in the following paragraphs.

(1) Obstructions to vision are as follows:

(a) Smoke. Fine ash particles suspended in the air. When smoke is present, the disk of the sun appears very red at sunset and sunrise and has a reddish tinge throughout the day. Smoke at a distance, such as from a forest fire, usually has a light grayish or bluish color.

(b) Haze. Dust and other material too small to be seen individually by the unaided eye. Haze reduces visibility and resembles a uniform veil over the landscape that subdues the colors. Haze appears bluish against a dark background but dirty or orange against a bright background such as the sun.

(c) Fog. Very small drops of water suspended in the air which reduce visibility. Fog appears grayish and feels damp on the skin.

(d) Blowing sand or dust. Dust or sand raised by the wind to such an extent that visibility is impaired.

(e) Blowing snow. No appreciable amount of falling snow, but snow from the ground is carried into the air by the wind and the visibility is reduced.

(2) Weather types are as follows:

(a) Precipitation. Precipitation includes all forms of moisture that fall to the earth's surface, such as rain, snow, and hail. All forms of precipitation can be classified as liquid, freezing, or frozen. Of special importance are the freezing types of precipitation, which present a great hazard to aviation.

1. Liquid precipitation.

   - Drizzle. Very small water droplets, which seem almost to float in the air and visibly follow air motion. Drizzle falls from fog or very low clouds.

   - Rain. Precipitation, which reaches the earth's surface as relatively large drops. Rain can be classified as light, moderate, or heavy, depending upon the rate of fall.

2. Freezing precipitation.

   - Freezing rain. Precipitation in the form of very cold raindrops, a portion of which freezes and forms a smooth coating of ice upon striking an exposed surface.

   - Freezing drizzle. Precipitation in the form of very cold drizzle, which freezes in the same manner as freezing rain.

3. Frozen precipitation.

   - Ice pellets. Frozen raindrops formed by rain falling through a layer of cold air. Ice pellets may adhere to any exposed surface, forming an uneven layer of ice.

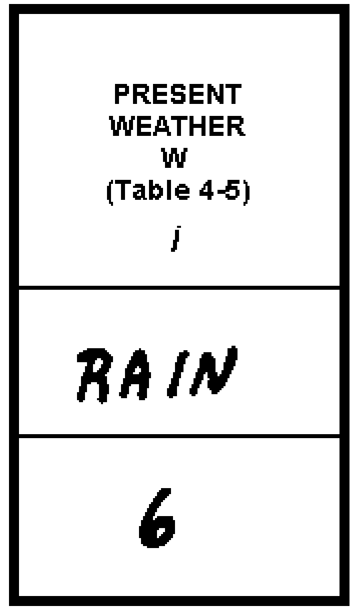
   - Hail. Precipitation in the form of balls or irregular lumps of ice. Hail results when water drops are repeatedly carried aloft to the colder air by the violent air currents usually associated with thunderstorms.

   - Snow. Precipitation composed of ice crystals.

   - Snow grains. Small grains of snow which are soft and opaque and lack the six-sided appearance of the ordinary snowflake.

(b) Thunderstorms. Thunder is heard at your location. A thunderstorm may or may not be accompanied by rain or hail.

(c) Tornado. A circular whirl, or wind of great velocity and small horizontal diameter. The horizontal diameter of a tornado varies from a few feet up to a mile, and the wind speeds often exceed 200 mph. Tornadoes are short lived, usually not lasting more than an hour or two. If a tornado is sighted, call your reporting station immediately and give its location and direction of movement. Speed in reporting your sighting is of the utmost importance to all concerned. Tornadoes are extremely rare in western Germany.



EXAMPLE: Rain is falling at the time of observation. To obtain the present weather code (Fig 16), refer to Table 4-5 of the extract on page A-3.

Actual conditions = Rain
SUPRP code = 6

Figure 16. Present weather.

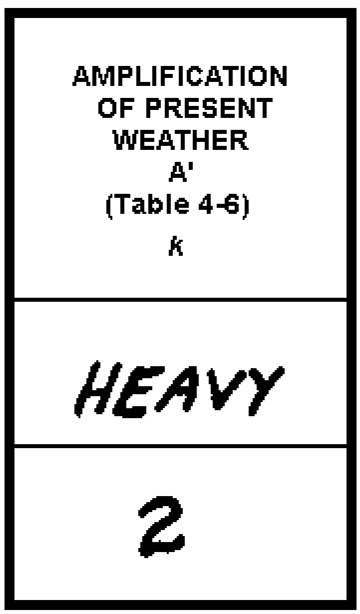


Figure 17. Present weather.

i. A'--amplification of present weather. This is an explanation or amplification of present weather (Fig 17).

EXAMPLE: Heavy rain is falling at the time of observation. To obtain the amplification of present weather code, refer to Table 4-6 of the extract on page A-4.

Actual conditions = heavy
SUPRP code = 2

j. HHH--station height. The height of the observation point above mean sea level is given in decameters using three digits (Fig 18).

EXAMPLE: 360 meters

$$\frac{360}{10} = 036$$

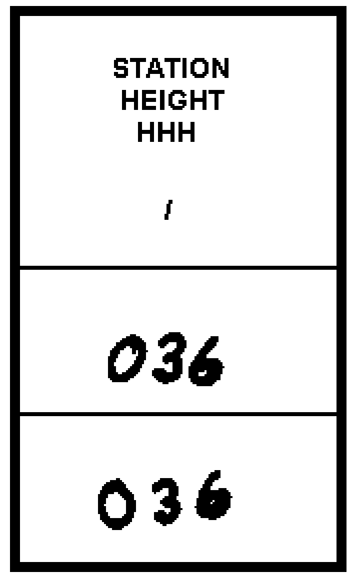


Figure 18. Station height.

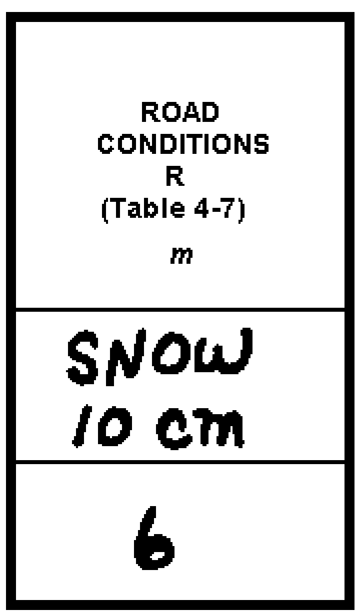


Figure 19. Road conditions.

k. R--state of road in vicinity of observation point. The condition of the roads (Fig 19) around the area of the observation point is given using Table 4-7 of the extract on page A-4.

EXAMPLE: Roads are covered with about 10 centimeters (CM) of snow.

Actual conditions = Snow 10 CM
SUPRA code = 6

l. T--state of terrain in vicinity of observation point (T). The condition of the terrain (Fig 20) around the area of the observation point is given using Table 4-8 of the extract on page A-4.

EXAMPLE: Terrain is covered with about 14 CM of snow.

Actual conditions = Snow 14 CM

SUPRP code = 7

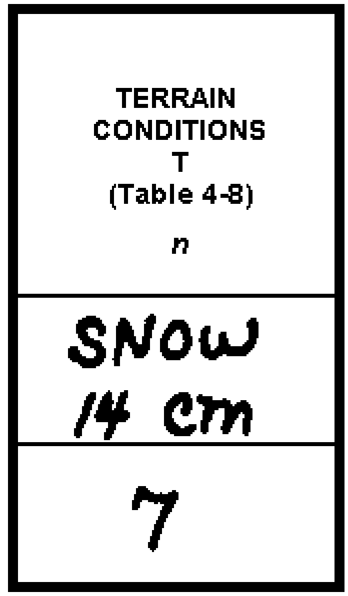


Figure 20. Terrain conditions.

. A--state of water surface. The condition of the water surface (Fig 21) around the area of the observation point is given using Table 4-9 of the extract on page A-5.

EXAMPLE: All water is iced to a depth of 6 to 8 CM

Actual condition = Ice 6-8 CM

SUPRP code = 7

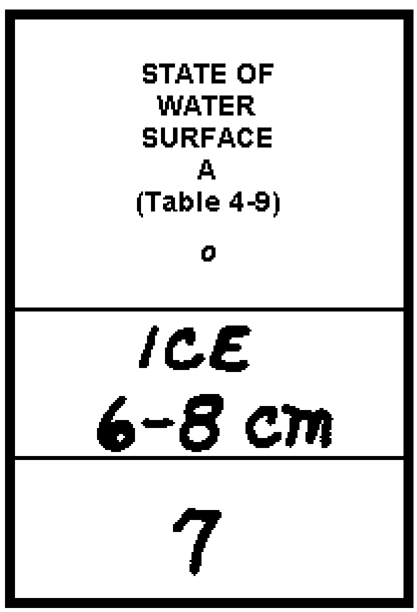


Figure 21. State of water surface.

n. TT--Temperature. Enter the air temperature in whole degrees Celsius (Fig 22). Negative temperatures are encoded by adding 50 to the absolute value of the temperature; e.g., -20^0 is coded as 70.

EXAMPLE: Actual conditions = -20^0C
SUPRP code = 70 (20 + 50)

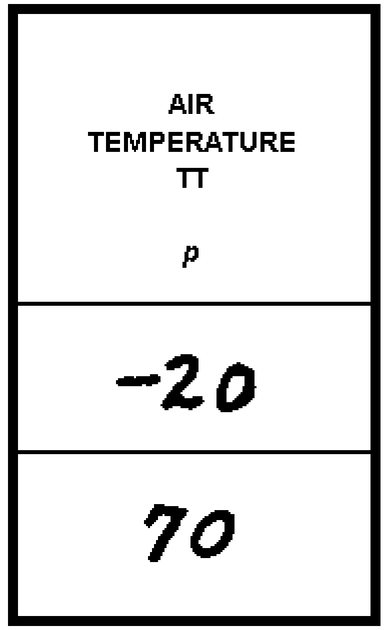


Figure 22. Air temperature.

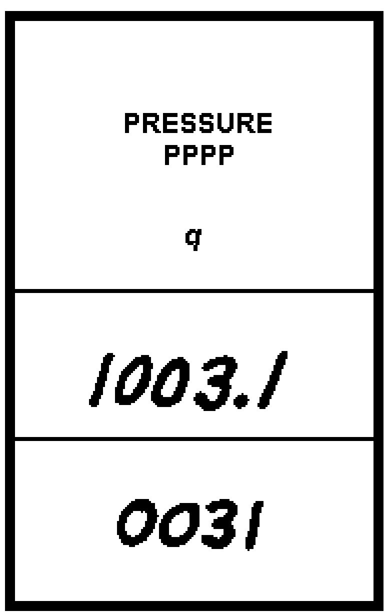


Figure 23. Pressure.

o. PPPP--pressure. The surface pressure (Fig 23) to the nearest tenth of a millibar is encoded. When pressure is over 1,000 millibars, the thousand digit (1) is dropped

EXAMPLE: Actual conditions = 1003.1
SUPRP code = 0031

p. dd--wind direction. The wind direction (in tens of degrees) is reported in two digits (Fig 24) in this portion of the code. These data are used to further amplify wind information reported in the fourth six-digit group (i.e., D and F). These two digits will be encoded as 99 when the wind speed is less than 5 knots.

EXAMPLE: Wind is blowing from 180^0.
Actual conditions = 180^0
SUPRP code = 18

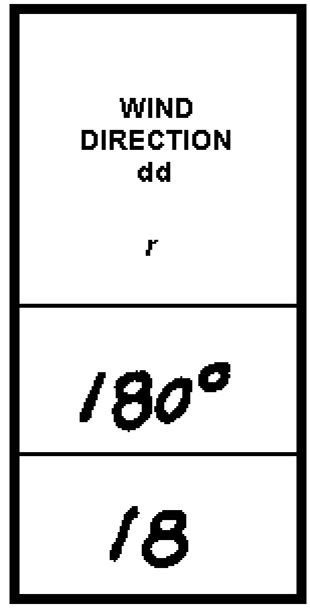


Figure 24. Wind direction.

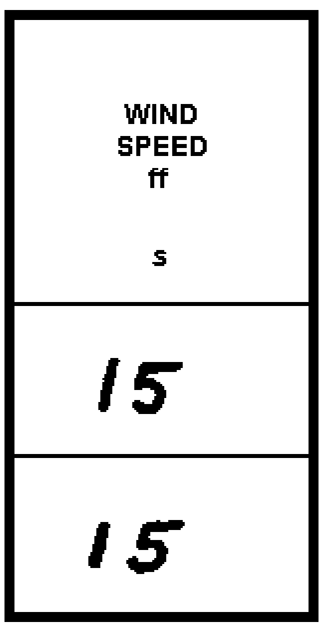


Figure 25. Wind speed.

q. ff--wind speed. The wind speed (Fig 25) is reported in knots and in two digits.

EXAMPLE: The wind speed is 15 knots.

Actual conditions = 15
SUPRP code = 15

r. Nh--amount of lowest cloud. The amount of lowest cloud is determined for the amount of cover in eighths and is encoded (Fig 26) using Table 4-10 of the extract on page A-5.

EXAMPLE: Amount of lowest cloud is 3/8.

Actual conditions = 3/8
SUPRP code = 3

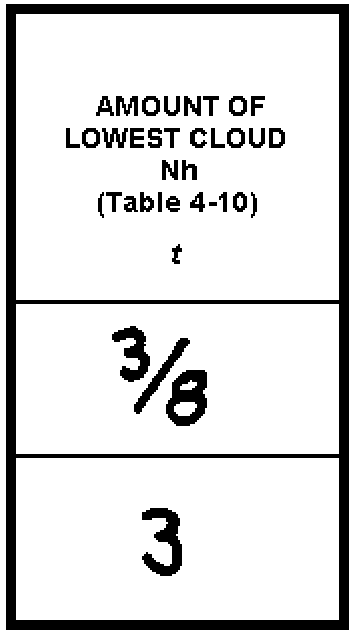


Figure 26. Amount of lowest cloud.

s. ha--height of lowest cloud. The height of the lowest cloud above the observing point is estimated and encoded (Fig 27) using Table 4-11 of the extract on page A-5.

EXAMPLE: The height of the lowest cloud is estimated at about 700 to 750 meters.

Actual conditions = 700-750
SUPRP code = 7

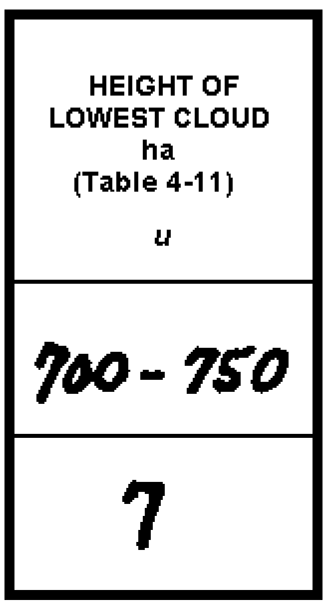


Figure 27. Height of lowest cloud.

t. 99--indicator for surf data.

(1) When the unit is located at a seacoast area, it is important to give surf conditions (Fig 28). The 99 group indicates that surf data will follow. The surf data include average height of breakers, time breakers last, direction of waves' approach to beach, and the width of the surf zone. For

estimation and encoding of these variables, see Tables 4-12, 4-13, 4-14, and 4-15 of the extract on page A-6.

(2) When surf data are not available, the message will end with height of low cloud plus any remarks on weather elements that might seem appropriate. Thus, the message includes seven six-digit groups when surf data is not included. Any data or weather element that is missing is represented by a slash (/) (Fig 28).

EXAMPLE: Average height of breakers in meters is 2. Period of breakers in seconds is 45. Direction of waves is from the right. Width of surf zone is not available.

INDICATION FOR SURF DATA 99 v	AVERAGE HEIGHT OF BREAKERS (Meters) Hs (Table 4-12) w	PERIOD OF BREAKERS (Seconds) Ps (Table 4-13) x	DIRECTION OF WAVES Dw (Table 4-14) y	WIDTH OF SURF ZONE Ws (Table 4-15) z
99	2	45	RIGHT	N/A
99	1	3	0	/

Figure 28. Surf data.

u. Plain language remarks.

(1) Any remark that the observer considers beneficial or explanatory may be listed at the bottom of the message. Examples are listed below:

(a) The direction of a thunderstorm from your location and the approximate direction it is moving toward; e.g., Thunderstorms E moving NE.

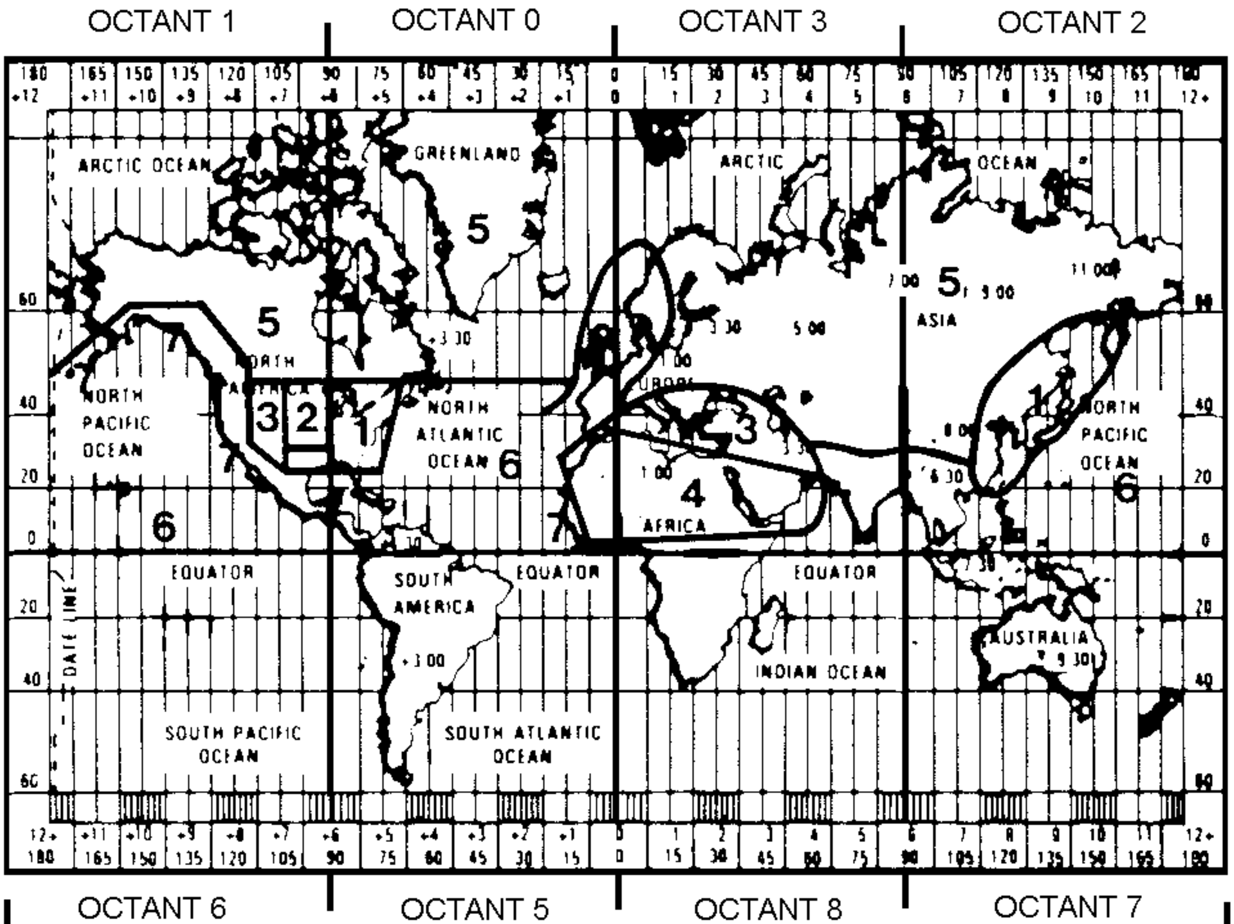
(b) The direction of lightning from your location; e.g., Lightning overhead and SW through NW.

(c) Obscuring phenomena at a distance from your location but not occurring at your location; e.g., Fog bank NE through SE.

(2) Any remark that you believe might be helpful to a military operation may be included, as long as that remark pertains to current weather.

14. SUMMARY. A request for a limited surface observation may be received at any time. The met section has the responsibility to be prepared to make the observation by conducting section training and becoming familiar with the SUPRP codes.

APPENDIX
EXTRACT OF FM 6-16-2



Time is calculated from the meridian of Greenwich. The middle of the zero time zone passes through Greenwich with its east and west limits 7°30′ on each side. Each 15 degree zone east and west of the initial zone represents one hour of time. The number of hours that must be added to or subtracted from local standard time to give Greenwich time is indicated for each zone.

1. Political boundaries in the various countries have caused modifications of the time zones. The vertical lines and clear sections are used to show to which zones these divisions belong. Where a half hour difference is legal, horizontal lines are used. Where no zone system has yet been adopted, the area is represented by small dots. Where no legal time has been establishsd, the larger dots are used. Variations from zone time are given in hours and minutes.

2. The seven climatic regions of the Northern Hemisphere are indicated and identified by the large black numbers 1 through 7.

3. Global octant is indicated by bold N-S, E-W lines and octant identification.

4-3. TABLES

A series of tables follows. These tables are used with the SUPREP code. They give an explanation of the code for each weather element to be reported by the observer. The tables help the observer determine what symbol to report.

Table 4-1. Na-Total Amount of Cloud Cover

Code Figure	Explanation	For Work Sheet (Abbreviation)
0	Clear (no clouds)	CLR
2	Scattered (1/8 - 4/8)	SCTD
3	Scattered (hills in clouds)	SCTD II
5	Broken (5/8 - 7/8)	BRKN
6	Broken (hills in clouds)	BRKN
7	Overcast (8/8)	OVC
8	Overcast (hills in clouds)	OVC II

Table 4-2. D-Direction From Which Surface Wind is Blowing

Code	Explanation	Degrees
0	Calm	
1	NE	023-067
2	E	068-112
3	SE	113-157
4	S	158-202
5	SW	203-247
6	W	248-292
7	NW	293-337
8	N	338-022
9	Variable	

Table 4-3. F-Force of Surface Wind (Beaufort Scale)

Code Figure	Description	Specifications	Approximate Knots
0	Calm	Smoke rises vertically	Less than 2
2	Light breeze	Wind felt on face and leaves rustle	3-8
4	Moderate breeze	Dust and loose paper fly about; small branches move	9-18
6	Strong breeze	Large branches in motion; whistling in wires	19-29
8	Gale	Twigs broken off trees; progress of person walking generally impeded	30-42

Table 4-4. V-Visibility at Surface

Code Figure	Explanation
0	Less than 50 meters
1	50-200 meters
2	200-500 meters
3	500-1,000 meters
4	1-2 km
5	2-4 km
6	4-10 km
7	10-20 km
8	20-50 km
9	50 km or more

Table 4-5. w-Present Weather and Obstructions to Vision

Code Figure	Explanation
0	No significant weather
1	Smoke or haze
2	Fog in valley
3	Sandstorm, dust storm, or blowing snow
4	Fog
5	Drizzle
6	Rain
7	Snow or rain and snow mixed
8	Shower(s)
9	Thunderstorm(s) with or without precipitation

Table 4-6. A' -Amplification of Phenomenon Reported by w

Code Figure	Explanation
0	No precipitation occurring
1	Light
2	Heavy
3	In the past hour, but not at the time of observation
4	Precipitation within sight
5	Freezing precipitation
9	Hail or ice pellets

Table 4-7. R-State of Road in Vicinity of Observation Point

Code Figure	Explanation
0	Dry
1	Wet
2	Flooded
3	Slush
4	Ice patches
5	Glazed ice
6	Snow depth 1 to 19 cm
7	Snow depth 20 cm or more
8	Snow drift

Table 4-8. T-State of Terrain Prevailing in Vicinity of Observation Point

Code Figure	Explanation
0	Dry
1	Wet
2	Pools of water on surface
3	Flooded
4	Ground frozen 0 to 4 cm
5	Ground frozen 5 cm or more
6	Snow depth 0 to 4 cm
7	Snow depth 5 to 24 cm
8	Snow depth 25 to 44 cm
9	Snow depth 45 cm or more

Table 4-9. A-State of Water Surface

Code Figure	Explanation
0	Water level normal
1	Water level much below normal
2	Water level high, but not overflowing
3	Banks overflowing
4	Floating ice (more than half)
5	Thin ice, complete cover, impassable for persons, 0-4 cm thick
6	Ice, complete cover, passable for persons, depth unknown
7	Ice, complete cover, depth 5-9 cm
8	Ice, complete cover, depth 10-24 cm
9	Ice, complete cover, depth 25 cm or more

Table 4-10. Nh-Amount of Cloud Reported at Height ha

Code Figure	Explanation
0	0
1	1/8 or less, but not 0
2	2/8
3	3/8
4	4/8
5	5/8
6	6/8
7	7/8 or more, but not 8/8
8	8/8
9	Sky obscured or cloud amount cannot be estimated

Table 4-11. Ha-Height of the Lowest Cloud Layer Above the Observation Point

Code Figure	Explanation
0	0-99 meters
1	100-199 meters
2	200-299 meters
3	300-399 meters
4	400-499 meters
5	500-599 meters
6	600-699 meters
7	700-799 meters
8	800-899 meters
9	900 meters or more or no clouds

Table 4-12. Hs-Average Height of Breakers

Code Figure	Explanation
0	Less than 1 meter
1	1-2 meters
2	2-3 meters
3	More than 3 meters

Table 4-13. Ps-Period of Breakers (Seconds) (Time Required for Successive Breakers to Pass a Given Point).

Code Figure	Explanation
0	0 to 10 seconds
1	10 to 20 seconds
2	20 to 30 seconds
3	More than 30 seconds

Table 4-14. Dw-Direction of Approach of Waves to Beach (Observer's Back to Sea)

Code Figure	Explanation
0	Waves approaching from right side
1	Waves approaching directly from rear
2	Waves approaching from left side

Table 4-15. Ws-Width of Surf Zone (Distance From Edge of Water to the Point Seaward that the White Caps of the Surf Begin to Appear)

Code Figure	Explanation
0	0 to 10 meters
1	10 to 20 meters
2	20 to 30 meters
3	More than 30 meters